SWEET BRIAR COLLEGE
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the IRON WORKER

Sweet Briar House
The President's Residence—Sweet Briar College

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THE IRON WORKER

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The Cover Picture. This view of Sweet Briar House can impart only a portion of its charm. The house and its gardens were not constructed by a single individual with a preconceived plan. Instead, Sweet Briar House and grounds are the result of over a century of love and work by three families, each adding to what the former had built.

In 1798, one Joseph Crouse, Senior, willed to Joseph Crouse, "the land on which I live." On this land was a six room, T-shaped, colonial farmhouse. Thirty-two years later, the house and some few hundred acres were sold in a mortgage sale. The property was purchased by Elijah Fletcher.

Fletcher, a New Englander, had settled in the area and had married Maria Antoinette Crawford, daughter of a wealthy landowner in the vicinity. As soon as the Fletchers had moved in, they added two three-story towers to the original structure which were definitely Italian in style.

It must have been around this time that the extensive planting was begun. Certainly, the Boxwood Circle was started then, for the size of these magnificent bushes can only be attained by many, many decades of growth. In addition to the circle itself, there are random plantings of boxwood and tall hedges surrounding the gardens. In total, there are about four hundred bushes, all over twelve feet high. Some of the trees must also date from this period.

In 1865, Indiana Fletcher, eldest daughter of Elijah and Maria Fletcher, married the Reverend James Henry Williams. Soon afterward, they established a summer residence in Sweet Briar House. It is not definitely known when the last major additions were completed, but several rooms were added to the rear of the house and a double arched gallery, in keeping with the Italian influence of the towers, was constructed along the facade.

Mrs. Williams also enlarged the gardens. The plantings, some from the Crouses, some from Mrs. Fletcher, and some from Mrs. Williams, include Norway spruces, English yews, magnolias, hemlocks, maples, locusts, white flowering catalpas, and delicate mimosas. A holly tree rises almost to the height of the spruces, and the feathery foliage of a fringe tree is pictured against a boxwood hedge.

This is how Sweet Briar House stood when Mrs. Williams died and when Sweet Briar College opened its doors six years later. The old house then proved its versatility. During the early days of the College, Sweet Briar House contained the President's residence, the post office, the treasurer's office, the infirmary, the college physician's quarters, and the offices of the President and her secretary, all at the same time! In addition, the drawing rooms on the lower floor were used for college receptions.

In 1927, Sweet Briar House was severely damaged by fire. The building was quickly repaired, and today it continues to serve as the President's residence and for college receptions.

It is pleasant to look upon this composite unit of house and gardens and think of its full and happy life in the past. It is more pleasant to think about the future of the house as an integral part of an important institution. Sweet Briar House has much to look forward to in the years to come.

GUEST AUTHORS

Martha von Briesen graduated from Sweet Briar College and holds a master's degree from Radcliffe College. Before returning to Sweet Briar College, she was on the staff of a Milwaukee newspaper and editor of a small monthly magazine. Upon her return, she served for several years as co-editor of the Sweet Briar Alumnae News. She is a past president of the Alumnae Association. Miss von Briesen has been Director of Public Relations at Sweet Briar since 1942.

George E. Sullivan, a graduate of Fordham University, has been a co-partner in the firm of Falconer and Sullivan Company, New York. Presently he is with Standard Publications. He has been a free lance writer for a number of years and his articles have appeared in many newspapers, trade and popular magazines.

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Sweet Briar College

The First Half Century

By Martha von Briesen, *Director of Public Relations, Sweet Briar College*

In September, 1953, Sweet Briar College will open its doors for the beginning of its forty-eighth academic session as a liberal arts college. The college today is a very different place from that of 1906, when the first handful of students presented themselves for enrollment. Theirs was the spirit of pioneers, a spirit which they shared with the first president, the first faculty members, and the board of directors. They all felt the excitement of beginning a new venture in education for women. Today, after years of growth and change, the college retains its essential forward-looking character, formulated so long ago.

Without a doubt, Sweet Briar's greatest charm still lies in the serene beauty of the campus, which the passing years seem only to enhance. So much apparent loveliness is apt to mislead the casual observer into overlooking the inherently dynamic life of the college. In spite of the fact that its setting is no longer remotely rural, thanks to modern means of transportation, the feeling of a closely knit community, based on common interests approached from many points of view, remains strong and vital. Friendly informality is still the characteristic most quickly noticed by strangers, who may not be immediately aware that it is an indication of the free give-and-take in student-faculty relations which is cherished by both groups.

Sweet Briar's story begins almost one hundred years before the college came into being. In 1810, a young man named Elijah Fletcher, a graduate of the University of Vermont, came to Amherst County to teach at New Glasgow Academy. Three years later, he married Maria Antoinette Crawford, daughter of a wealthy landowner whose home, Tusculum, was near New Glasgow. It is not definitely known when Fletcher gave up his teaching to become a business man and farmer, but by 1820 he had acquired much of the land which now belongs to the college. Local legend relates that it was Mrs. Fletcher, inspired by its abundance of wild roses, who named the property Sweet Briar.

Apparently the Fletchers used Sweet Briar for a summer residence, for they lived in Lynchburg until 1841, when Mr. Fletcher sold "The Virginian," at that time Lynchburg's only daily newspaper. The old farmhouse at Sweet Briar was enlarged by the addition of two wings, each with a square three-story tower. An arched portico was also added to the front of the house. The Fletchers had already planted much of the extensive boxwood garden which surrounds Sweet Briar House and which contributes so much to the fame of the place today.

Indiana, the elder daughter, inherited Sweet Briar after her father's death in 1858. She later married the

The last of the log cabins of the Sweet Briar Plantation. The cabin is now used as an oratory.

Reverend James Henry Williams, an Episcopal clergyman, and in 1867 their only child, Maria, was born. Daisy, as she was always called, spent much of her brief life at Sweet Briar. Her love for the rolling fields, the shady woodlands, and the distant blue hills is everywhere apparent in the entries she made in her diary during the two years preceding her death in 1884.

Daisy's parents, stricken by her untimely death, soon began to think about a permanent memorial to their child. When Mr. Williams died in 1889, he left all of his property to his wife and his will expressed the hope that an educational foundation might eventually be established in memory of Daisy.

During the last ten years of her life, Mrs. Williams must have spent much time and thought in planning the outlines of the foundation. She had outlived all the members of her immediate family, and in her loneliness she withdrew almost completely from the activities which had formerly taken her away from Sweet Briar. She died in October, 1900, and within a few days was buried in the hilltop cemetery beside her husband, her parents, her sister, and her only daughter.

When Mrs. Williams's will was published in November, 1900, the extent and wisdom of her planning became evident. Her intentions can best be understood by a reading of the will, particularly those sections which pertain to the projected institution. Specifically, she said, "I direct the said trustees forthwith after my decease to procure the incorporation in the state of Virginia of a corporation to be called the 'Sweet Briar Institute' . . . . . The said corporation shall with suitable dispatch establish, and shall maintain and carry on upon the said plantation, a school or seminary . . . . . for the education of white girls and young women.

"It shall be the general scope and object of the school to impart to its students such education in sound learning, and such physical, moral and religious training as shall, in the judgment of the directors, best fit them to be useful members of society . . . .

"I desire that the school shall be made self-supporting, so far as practicable; but it is my hope that the board of directors may be able, from the income placed at their disposal, to establish scholarships affording tuition and maintenance for a limited number of deserving students, which scholarships shall be awarded under such rules and regulations as the board may prescribe . . . . ."

In concluding this remarkable document, Mrs. Williams stated: "This bequest, devise and foundation are made in fulfillment of my own desire, and of the especial request of my late husband, James Henry Williams, solemnly conveyed to me by his last will and testament, for the establishment of a perpetual memorial of our deceased daughter, Daisy Williams."

To confirm this high purpose, Mrs. Williams left the bulk of her fortune. She left more than eight thousand acres of land, including some property in Lynchburg and in Amherst County in addition to what she referred to as the "Sweet Briar Plantation," and personal prop-

DAISY WILLIAMS

(1867-1884)

This portrait of Daisy Williams hangs in the west parlor of Sweet Briar House. It was in her memory that Daisy's parents made broad plans for a school for girls which opened as Sweet Briar College in 1906. Daisy was born at Sweet Briar and lived most of her short life there. To make up for her lack of playmates, she took great interest in the farm. Her diary and letters are filled with references to the planting and harvesting of various crops, to the care of the farm animals, and to the progress of the gardens. Early in 1884, Daisy died of pneumonia in New York.

erty which totaled more than half a million dollars after certain specific bequests were taken care of.

The four original trustees of the will set out immediately to follow her instructions. These men, the Right Reverend A. M. Randolph, Episcopal Bishop of Southern Virginia, the Reverend T. M. Carson of Lynchburg, the Reverend Arthur P. Gray of Amherst, and Stephen Harding of Amherst County, secured the charter of incorporation from the state legislature in February, 1901. They added three more men to round out the first Board of Directors: the Reverend Carl E. Grammer, then of Norfolk and later of Philadelphia; Dr. John M. McBryde, president of Virginia Polytechnic Institute; and Judge Legh R. Watts of Portsmouth.

The first Board of Directors was apparently fired by the same determination which had inspired Mrs. Williams. With such a romantic name, setting and origin, the school might easily have become a pleasant finishing school. Instead, the Board chose a course of action which reflected the spirit of the new century and which was already evident in the progress made by the older women's colleges. At their first meeting, these men stated that "it is the declared wish and purpose of its Board of Directors to give such shape and scope to Sweet Briar Institute as will make it a worthy monument to the liberality of its founder and the first among the establishments for female education in the state and the south." The four clergymen and three laymen also decided that the institution should be "free from denominational control, but distinctly religious in character" and that it should maintain the highest college standards, uniting classical and modern ideals of education. Having set up the outline of the Institute, they were wise enough to leave the actual contents of the curriculum to the teachers and administrators who were to come. The directors did not forget Mrs. Williams's

This view of the dignified hallway of Sweet Briar House was taken before the fire of 1927.

wishes on the matter of scholarships. They promptly made provision that any girl who lived in Amherst County and who could meet the entrance requirements on the same basis with other applicants should be given free tuition. This provision is still in effect, and over the years, several hundred Amherst County residents have attended Sweet Briar at very little expense.

Five years passed between the granting of the charter and the opening of the college. In 1903, the Directors authorized contracts for the construction of the first

The gracious facade of Sweet Briar House, now used as the President's residence.

Mary Kendrick Benedict, first President of Sweet Briar College, 1906-1916.

buildings, in accordance with the plans of the architects, Cram and Ferguson, of Boston. At the same time, roads were built, water and sewage systems were installed, a power plant was erected to provide heat and electricity, and a stream was dammed to provide an adequate water supply. The bricks for the original buildings were fired on the grounds, their color and texture blending with the red soil of the region. By the spring of 1906, the physical plant was nearing completion. It consisted of a class room building, Academic, which also housed the chapel, assembly hall, and library; the Refectory; two dormitories, named for Mr . Gray and Mr. Carson; and four

One of the college's earliest means of transportation, the stage met trains at Sweet Briar Station.

Class Day at Sweet Briar in 1910.

faculty houses. Faculty, staff, and students were still needed to bring the college to life.

That same spring, the directors named Dr. Mary K. Benedict, a graduate of Vassar and of Yale, as the first president of the institution. According to the Richmond *Times-Dispatch,* Dr. Benedict "had the honor to be the only woman president of a college of higher education in Virginia, if not in the south." Dr. Benedict arrived in early June to face an almost overwhelming task. Furnishings and equipment had to be ordered for the unfinished buildings, the curriculum had to be planned, a faculty and staff obtained, and countless details had to be cleared up quickly if the college was to open in September, as the directors hoped and expected. Last, but not least, there must be students.

Only one girl, Lillian Lloyd of Lynchburg, was on the rolls in June, but on the opening day there were fifty-one, of whom fifteen were day students. The faculty numbered eleven, the staff four. During that first

Skaters enjoying the Sweet Briar Lake in 1912.

Basketball is still popular at Sweet Briar, but the costumes have changed slightly.

➤ The class of 1919 posed for this photograph with high hopes, for at the time they were but freshmen.

academic year, the athletic association, the Christian association, the dramatic and music clubs, and many other student organizations were started. Most important of all, student government was established under a charter granted by the faculty. When spring came, the first of the famous Sweet Briar May Day celebrations was held in the Boxwood Circle, with the spectators gathered on the front porch of the old plantation house, and Mrs. Williams's peacock strutting on the lawn.

The problems of the young college were many. By the time the doors had opened for the first year, almost all of Mrs. Williams's original bequest had been expended on the physical plant. In order to make both ends meet, the college had to rely on student fees. There were lean years during the first decade when all but the stoutest hearts must have been ready to admit defeat. Among those who stood firm throughout the years was William B. Dew, treasurer of the college from 1906 to 1942, who guided the college's financial affairs with great care and foresight through three administrations. Many others who shared the burdens of those early years earned the undying gratitude of those who later succeeded them.

All of these pioneers looked to the tall, serene, determined young woman who headed the institution. Although only thirty-one years old, Miss Benedict had a maturity of outlook which far exceeded her years. She had a vision of the future of Sweet Briar, and she expended every effort towards the realization of that vision. She shared the joys and sorrows, the aspirations and discouragements of all, serving not only as president, but also as dean, counselor, and registrar. The rare combination of qualities which were embodied in its first president left their mark on the young institution.

One point on which all were agreed was that the academic standards must be of high quality. This posed some problems in the early days because relatively few students could meet the entrance requirements. The college refused to lower its standards. In order to overcome this difficulty, the college offered sub-freshman courses for those who were not yet ready for the normal

This peacock, owned by Indiana Fletcher Williams, roamed the campus for many years after the death of his mistress.

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SWEET BRIAR COLLEGE
CHARTERED 1901
THIS LIBERAL ARTS COLLEGE FOR WOMEN, OPENED IN 1908, GRANTED ITS FIRST BACHELOR OF ARTS DEGREES IN 1910. ESTABLISHED UNDER THE WILL OF INDIANA FLETCHER WILLIAMS AS A MEMORIAL TO HER ONLY DAUGHTER, DAISY. THE COLLEGE IS LOCATED ON A 2600-ACRE TRACT OF LAND ACQUIRED BY ELIJAH FLETCHER BEFORE 1830. THE EIGHTEENTH CENTURY HOMESTEAD, REMODELED AND NAMED "SWEET BRIAR HOUSE" BY THE FLETCHERS, IS SET IN A BOXWOOD GARDEN.

This historical marker is situated on Route 29 at the entrance to the college.

Emilie Watts McVeo, Sweet Briar's second President, 1916-1925.

curriculum. This Academy, as it was later called, was closed in 1919.

June, 1910, brought Sweet Briar's first commencement. Five proud and happy young women received the college's first bachelor of arts degrees, modeled after Elijah Fletcher's 1810 diploma from Vermont. Sweet Briar's degree was soon recognized by the graduate schools of Columbia, Yale, Cornell, and other universities.

In 1916, Miss Benedict resigned to continue the study of medicine at Johns Hopkins, thus terminating an era at Sweet Briar. During that first decade, three more dormitories had been built. Like Gray and Carson, they were named for directors: Randolph, Manson, and Carl Grammer. The student body and the faculty had increased, and seven classes had been graduated.

Dr. Emilie Watts McVea, who had been Dean of Women at the University of Cincinnati, became the second president. Hers was the task of guiding Sweet Briar through the difficult years of the first world war and the post-war period. Miss McVea was a talented speaker. Wherever she went, she won new friends for Sweet Briar. She initiated monthly discussion groups at Sweet Briar House for the women of Amherst County, who traveled in buggies and carriages over the precarious red dirt roads to attend these meetings. In 1922, Miss McVea organized the first Amherst County Day, now an annual event in the spring when the college plays host to young and old in Amherst County.

Frail health forced Miss McVea to resign in 1925. Her administration had seen Sweet Briar recognized by the Southern Association of Colleges and Secondary Schools, the American Council on Education, the American Association of University Women, and the Association of American Universities. During that time, several additions to the physical plant were also made: four more faculty houses, the infirmary, Boxwood Inn, and Fletcher, built to provide more classroom space and room for the administrative offices, formerly located in Sweet Briar House. The sixth dormitory, named for Fergus Reid of Norfolk made it possible to increase the student body to 450.

Miss McVea was succeeded by Dr. Meta Glass, member of a distinguished Lynchburg family and a graduate of Randolph-Macon Woman's College. Miss Glass held a doctorate from Columbia University where she was engaged in administrative work when she accepted the appointment as the third president of Sweet Briar College.

For twenty-one years Miss Glass directed the course of the college. To strengthen the academic program,

THE BOXWOOD CIRCLE

In front of Sweet Briar House stands the wide, curving Boxwood Circle. This majestic arrangement is famed far and wide as one of the most distinctive features of the boxwood plantings which surround the old house and gardens. The circle itself is comprised of thirty-one bushes which rise about twelve feet above the ground. All in all, there are about four hundred boxwoods on the grounds. It is generally agreed that the Boxwood Circle must have been planted about one hundred and thirty years ago because of the maturity and size of the magnificent bushes. It is also agreed that all of the boxwood around Sweet Briar House come from Kew Gardens in London.

Meta Glass, third President of the college, 1925-1946.

she increased the endowment from $133,000 to almost $1,000,000. During her administration, several new buildings were added to the already imposing campus, and noteworthy revisions in the academic program were accomplished. Early in the thirties, several new departmental and interdepartmental major programs were initiated, as well as the honors plan of study, participation in the University of Delaware's Junior Year Abroad, and a special program for the junior year at St. Andrews University in Scotland.

In addition to the construction of the Daisy Williams Gymnasium, the Book Shop, a faculty apartment house, the indoor riding ring, the outing cabin on Paul's Mountain, the new boat house, and several faculty houses, Miss Glass's administration saw the building of the Mary Helen Cochran Library. This magnificent gift

The spacious main reading room of the Mary Helen Cochran Library.

of Mr. Reid, which bears the name of his mother, dates from 1929, and was the answer to Sweet Briar's greatest need. As the library's collection has expanded, so has the depth and breadth of Sweet Briar's curriculum. During the past 23 years, the collection has grown from 19,000 volumes to more than 78,500. How well it serves the needs of the college is aptly demonstrated by the fact that over 21,000 books were circulated in 1952.

Grants from the Carnegie Corporation made possible major programs of study in both music and art. The

The facade of the Mary Helen Cochran Library, opened in 1929.

Martha B. Lucas, fourth President of Sweet Briar College, 1946-1950.

academic program was further strengthened by the establishment of the Carter Glass chair of government, the addition of several scholarship endowments, and the inauguration of sabbatical leaves and a retirement plan for faculty members.

Miss Glass served twice as president of the American Association of University Women. She was also president of the Association of American Colleges, and of the Association of Virginia Colleges. Honorary degrees were conferred upon her by several leading colleges and universities.

In 1946, Dr. Martha B. Lucas, a graduate of Goucher College and of the University of London, became the fourth president of Sweet Briar. Her administration was marked by increased interest in Sweet Briar's role in promoting international understanding. Several Sweet Briar students were named as delegates to conferences in England, Germany, and Scandinavia; others joined summer work camps in France and Germany. Sweet Briar offered more scholarships to foreign students. Miss Lucas herself was a delegate to the fourth UNESCO conference in Paris in 1949.

Student waitresses at work in the Refectory.

Foreign students at Sweet Briar during the current academic year represent (from left) Scotland, Austria, China, Denmark, and France.

Starting in 1948, Sweet Briar began its administration of the Junior Year in France. Now in its fifth year under Sweet Briar's auspices, the program has opened doors to international understanding for almost four hundred young men and women from eighty American colleges and universities.

Sweet Briar's reputation in academic circles was confirmed in 1949 by the Phi Beta Kappa Society. A charter was conferred which established the Theta of Virginia chapter at the college. Along with the first group of undergraduates, ten outstanding alumnae from the classes preceding 1940 were selected for membership.

The current phase of Sweet Briar's continuing progress started in 1950 when Dr. Anne Gary Pannell became the fifth president of the college. Mrs. Pannell is a graduate of Barnard College and holds her doctorate in history from Oxford University. She has carried

The 1951 group of students from all over the United States embarking for their Junior Year in France under the auspices of Sweet Briar College.

Anne Gary Pannell, fifth President of Sweet Briar College, with sons Gary and Clifton.

Sweet Briar's name far and wide, as she is in great demand as a speaker. Her personal charm and friendliness and her deep conviction regarding the essential values of the liberal education as exemplified at Sweet Briar have combined to win many new friends for the college. Mrs. Pannell has gone forward with Sweet Briar's many-sided efforts to promote international understanding. She is currently serving as international relations chairman for the American Association of University Women. In the past five years she has addressed conferences in Canada, Switzerland, Holland, and Italy.

The college's connections with other countries have also been strengthened in recent years by student ex-

The boathouse on Sweet Brior Lake where students swim, fish, go boating and enjoy picnics and outings.

The College Council, composed of students and faculty, in one of its regularly scheduled meetings. Topics of community interest and changes in student regulations are the Council's chief concerns.

changes and by the addition to the faculty of men and women who are natives of other lands. In the last decade, two Chinese students and an Indian student have been graduated from the college. Last June, the first Viet Namese student, previously elected to Phi Beta Kappa, received a Sweet Briar degree, *magna cum laude*. Since the war, girls from France, Germany, Finland, Holland, Spain and Japan have held scholarships

A zoology laborotory class in Academic Hall under the guidance of Professor Jane Belcher.

at Sweet Briar. During the current year, their numbers have been augmented by students from Austria, France and Denmark, and this year, the third girl from St. Andrews University is attending the college.

Student interest in these programs is very strong. For the past seven years, two all-expense scholarships each year have been provided from proceeds of the annual community drive for funds conducted by the students. Five years ago, the students began to work for a

The rolling countryside is ideol for the regular drag hunts of the Sweet Briar Hunt.

St. Paul's Mission School at Bear Mountain, where Sweet Briar students have long done volunteer work with the children.

D. P. scholarship. By eating a "meager meal" once a week throughout the academic terms, they raised enough money in two years to grant the scholarship. It was held by a German girl who majored in sociology and completed her course in 1952.

While active in international affairs, Sweet Briar students have also been active in those near home. Since the earliest years, they have maintained a regular program of volunteer service at St. Paul's Mission School and in several small county public schools. They have cooperated with local citizens in starting various recreation projects for young people, through the county welfare agency. Continuing a custom of many years standing, a student serves on the Amherst County Health and Welfare Council, successor to the Amherst County Health Association which Sweet Briar faculty members helped to organize more than thirty years ago.

Young women from all over the country continue to come to Sweet Briar. They come in almost equal numbers from south and north, from public and from private schools. The class of 1952, the largest class ever graduated from Sweet Briar, had ninety-six members. They came from twenty-four states, the District of Columbia, three foreign countries, and Hawaii. Virginia had the largest representation with fifteen members. Seventeen seniors chose English as their major field, eleven chose religion, eleven government, seven sociology, six history, and four political economy, one of the interdepartmental majors now being offered.

Small classes allow more time for individual attention. Here, a creative writing workshop meets with the professor, Mrs. Evelyn Eaton.

Some classes, such as this music listening hour, are student-monitored.

It has often been said that all education is "unfinished business." The belief is strong at Sweet Briar that the best college education is that which stimulates its participants to continue to extend their mental growth. Further, the college believes that a "liberal" education, one which truly liberates the mind and spirit in the best sense of the word, is more than ever the best basic equipment for young women who will be called upon to adapt themselves to countless unforseen situations in their future lives.

Sweet Briar, while remaining steadfast to its principles as a liberal arts college, has made many changes in its curriculum in attempting to meet the changing needs of its students. The students, too, have changed considerably over the years. It is true that they have retained many of the old traditions dear to earlier generations of students. May Day, step-singing, Lantern

The lighter side—the annual baseball game between two student organizations and their dates usually turns out to be something that Abner Doubleday would never have recognized.

The Daisy Willioms Gymnosium, completed in 1931, wos financed by student contributians from 1922 through 1931.

Dormitories Grammer and Reid framed by one of the huge elm trees which dot the compus.

Night and many other occasions are still observed with mingled joy and nostalgia, but at the same time, the students have taken a much more important role in the management of their own affairs through their Student Government Association. As the concept of the liberal arts education has broadened, so the students themselves have reached out for more and better opportunities to express themselves.

This brief picture of a college of the twentieth century shows an adventure in education which has made great progress through the years and which rests firmly on a strong academic foundation. With the help of all its alumnae and friends, Sweet Briar will continue its progress during its second half-century to prove over and over again the validity and soundness of the liberal arts education for young women.

The wide lowns and stately planting of Sweet Briar's grounds make it one of the country's most beautiful colleges.

T. W. CURRY

Some Tools for Quality Control in the Mechanized Jobbing Foundry

By T. W. Curry, *Director of Manufacturing Research and Methods*

This paper by T. W. Curry, Director of Manufacturing Research and Methods, was originally presented at the 24th annual meeting of the Gray Iron Founders' Society, Inc., in Cleveland, Ohio, on October 16, 1952. Mr. Curry, a member of the Society's Quality Control Committee, presented the paper in a panel discussion on Quality Control.

For presentation in The Iron Worker, *the text has been changed as little as possible. Some photographs have been substituted, and some are additional.*

—The Editor.

WHEN did our quality control program start? How did it start? Who started it? Who keeps it going? Why was it necessary? Are we financially better by having it? Where does it end? I believe that if we consider these questions carefully, we will find it quite difficult to state an accurate answer except to two. First, an effort toward quality control benefits each individual of the foundry group and their company financially, and the financial benefits increase as the efficiency of the quality control program increases. Second, everyone in the foundry organization from the president down is involved in the quality control program to make it successful.

There are two focal points at which an effective improvement and advancement in a quality control program may be realized; namely, the daily scrap castings in the foundry and trouble-shooting in the customers' plant. These are based on post-mortem observations, but good progress can be made by starting from these points, if a carefully planned attack is made on each of the problems arising. There is, of course, necessary preplanning for quality before the castings are made, but it is questionable as to whether any group's combined knowledge of foundry technique can forsee all the variables that might be encountered and compensate for them in advance.

THE RECORDING OF DEFECTIVE CASTINGS

The success or failure of a foundry quality control program is greatly influenced by the correct designation for the cause of casting defects. It is necessary to determine an accurate cause of the defect in the scrap casting, and make a record of it in the daily scrap analysis.

We have a committee composed of the foundry supervisor and superintendents of the core room, melting department, pilot foundry, cleaning room and pattern shop, the plant metallurgist, the plant inspector, and a clerk who records the findings of this group. We found it absolutely necessary to have the combined efforts of this group of men to correctly determine the cause of scrap defects and, even with this type of study, some of the real causes of casting defects are not determined without subsequent follow-up and more study by special tests, chemical analyses, and on-the-job study of molding and core making operations.

Our plant manager insists that this group be present at the scrap take-up each day.

In order that this group may do an intelligent job of analysis and correlate their findings with our sand and metal control and our production procedures, each casting has a pattern number, a date, and shift number cast on its surface. When castings are rejected at the various inspection stations, they are taken to one central location and separated by date, pattern number, and shift number. We have three shake-out stations and three cleaning rooms as well as numerous final inspection stations where dimensions are checked. Defective castings from all of these stations go to the one central scrap take-up station.

In any foundry operation, if this scrap take-up is handled in this manner, there is no question that all of the defects listed in the AFS *Analysis of Casting Defects*, and more, will be uncovered at some time or another. Quality control can then be started or improved by carefully studying the cause of the defect, establishing a method and/or correcting all the materials in-

Latham L. Page, Loss Clerk, Carl B. Stone, Foundry Methods Supervisar, George P. Simpson, Superintendent of Cleaning, Harvey W. Harriss, Assistant Works Manager, and Walda C. Watkins, Chief Inspectar at Lynchburg, at the daily scrap take up.

volved to set up procedures so that the defect cannot recur.

The records of the causes of casting scrap obtained at the scrap take-up meeting are statistics which will indicate the place to begin to improve quality control. For example, the scrap loss may be predominantly caused by a sand condition rather than a metallurgical or mechanical deficiency. There does not seem to be any question that proper records will show where the greatest economies can be made and direct quality control efforts toward the factors responsible for the greatest loss.

It is obvious that if you have a mold shift, core shift, a swell or a crush, it will be necessary to set up facilities to measure pattern equipment, cores and core boxes, and the final castings.

If you have shrinkage, metal hardness, chilled edges, and misruns, it will be necessary to start chemical and temperature controls of the metal used to pour the castings.

If you have sand holes, buckling, scabbing or a blow, it will be necessary to set up sand control in both the molding and the core-making departments.

The shrinkage, sand holes, slag holes, and blowing also indicate the need for a careful study in gating and risering techniques.

The correct analysis of casting defects, and their subsequent elimination and control, form the basis for improvement and development in a foundry quality control program. From this point we have moved in the direction of closer control of sand and metal, established inspection in the plant and in the field, have revised our molding and core-making procedures, and have found it advantageous to set up a small pilot foundry to improve our knowledge of gating and risering and general foundry techniques.

INSPECTION OF THE CUSTOMERS' MACHINING AND ASSEMBLY OPERATIONS

Following the castings made in your foundry through your customers' machining and assembling operations points out further defects which, if corrected, improves the quality of the castings and reduces the scrap loss in the foundry. Study of the defects encountered in the field indicate that leakage, warpage, cracking, internal porosity and deviation from proper dimensions are the principal causes for complaints.

The major portion of our field work to improve our quality control is carried out by our inspection department. This is one of the reasons for having the chief inspector or the plant inspector at the daily scrap take-up meeting.

On the basis of the findings in the field, we have improved our dimensional tolerances, as cast, have recommended and have had accepted changes in design to eliminate internal porosity and simplify the manufacture of the casting, have obtained permission to alter patterns to bring the casting to the required drawing dimensions, have simplified the customer's finishing operations by eliminating special machining set-ups and touching-up for assembly operations, and have used this information from the field almost wholly for the design of jigs and

Raleigh C. Mays, Jr., Superintendent of Foundries, and a customer's representative checking casting dimensions in the inspection room.

fixtures for core assembly, core-setting operations and final casting inspection.

The work of our chief inspector in the field has become one of our best customer-relations activities. From his study of our castings in the customers' plants and by closely following up the findings and recommendations of our chief inspector, we have established excellent low-rejection records in the field which are more important than maintaining a low scrap loss in the foundry although both are obviously desirable.

ANALYSIS OF THE COST OF LOSSES

In order that the quality control program be kept moving in the direction of the greatest cost savings, we inform our operating supervision of the cost of the scrap loss by giving them a breakdown of the operating costs, profits as determined at the shop level, and the cost of each individual casting when it is ready for shipment.

This cost analysis for the preceeding week, which includes the total cost of the scrap losses and a breakdown by each pattern number, is discussed once each week in a meeting at which all operating supervision is present. The relationship between shop profits and the cost of this scrap loss has taught us to think in the terms of money loss rather than per cent scrap loss by weight.

If, for example, a heavy pulley or flywheel is running

Winston H. Blankenship, Budget and Cost Control Supervisor, going over the weekly cost and profit figures of the shop. This meeting is regularly attended by over fifty supervisors.

The extent of the foundry cleoning operotions is a good storting point and guide for a quality control program.

at a five per cent loss as compared with a transmission case or a heavily-cored type of casting at the same percentage of loss, the losses in the latter two castings would usually be the more expensive to the foundry operation. Hence, immediate action should be taken on the castings which are causing the most loss in shop profits rather than working on reduction of the per cent loss by weight of all castings.

It is imperative in any foundry quality control program that those people actively engaged in supervising production be kept informed of all operating costs. A reduction in these costs is the direct objective of the quality control program.

CLEANING COSTS AS A STARTING POINT FOR QUALITY CONTROL

A study of the foundry cleaning costs is also an excellent place to begin to set up procedures for the control of quality in the castings. Careful investigation of the cleaning operation for work simplification will point out

The finish of castings is but one of the mony yardsticks for meosuring the efficiency of a quality control progrom. Here, Warren G. Woadson is doing some careful grinding and touching on the interior of a motor frame.

The economics of the table blast may indicate areos where quality control will pay big dividends. Neville Moorefield ond George W. Tanner ore the operators.

those conditions which will lead back through molding and core sands, mold and core washes, gating and risering, cupola melting, pouring temperature, and the equipment used to make the castings.

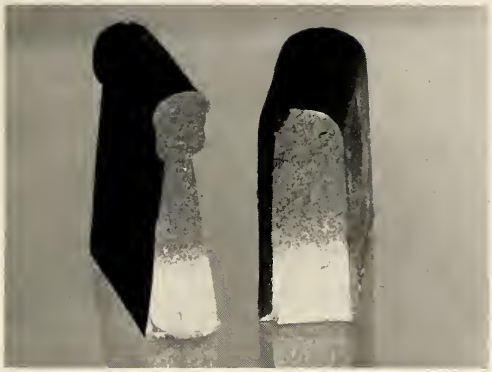
The elimination of unnecessary fins, for example, or the adjustment of the thickness and position of the fins, will usually end in a complete set-up for core-assembly fixtures, core-setting fixtures, pins-and-bushing maintenance, cope close-up equipment, and a thorough study of the core sand mixtures to eliminate sagging and to control baked core dimensions. Elimination of fins will also demand a study of molding sands and ramming equipment.

One of the more expensive items involved in cleaning costs is penetration. It is obvious that the elimination of this sand and/or ramming defect will involve a study of molding sands, core sands, molding machines, and will indicate the necessity for a full scale sand control operation.

Excessive chipping of gate and riser scars or cost of removal of sprue requires a fundamental study of the size of risers, riser connections, and gates to reduce this cost. A study of this type will automatically improve the yield in any foundry operation.

The cleaning room is cited as a second starting point for furthering a quality control program because, gen-

The "whirley" spout from the forehearth allows for a better recovery in late alloy additions.



A careful analysis of the chill fractures from each ladle of iron aids immeasurably in close control of metal composition.

erally, the cost of scrap losses in the foundry and in the field is greater than the expected reduction in cleaning costs by the introduction of quality control methods from this base. There is, however, no reason why both programs may not proceed simultaneously.

THE CHILL TEST FOR METAL CONTROL

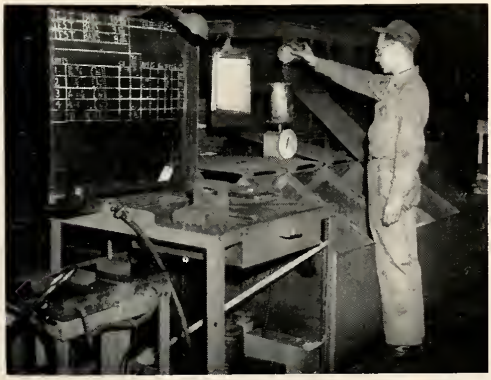
Much has been written by many investigators on the use of the chill test and the importance of their findings should not be minimized. We use the chill test extensively, and it is a very effective tool in the quality control program of our foundry.

The literature published concerning the chill test, in some respects, may discourage foundries from its use; however, a chill test which has been carefully correlated with the physical properties of the metal in the castings being produced is a desirable tool. Certain precautions should be taken in the design and procedure for obtaining a chill test and attention is directed to the following:

1. The chill test should be designed in such a way that a gray-white fracture is available for observation. Obviously the design of the chill test, therefore, is dependent on the composition of the metal which the foundry is pouring.

2. Our findings, to date, indicate that a chill test should be made in a dry sand mold, poured on a water-cooled block, poured at the same rate from sample to sample, poured from the same gating position, poured in the same range of temperatures (2450-2550 F.) using a hot, dry sample ladle, and the chill sample should be fractured in the same position. Observation of the depth of chill and the gray fracture should be correlated with some chemistry, preferably total carbon and silicon, the physical properties of the metal in a test bar, and the physical properties of the metal in the castings.

Maynard V. Wilmer, Assistant Cupola Foreman, Special Foundry, taking chill sample.



Elmo H. Crews, Alloy Man, Special Foundry Cupola, carefully weighs each alloy addition.

Earnest G. Carey checking the Brinell Hardness on castings from the production line as soon as they can be cooled and cleaned.

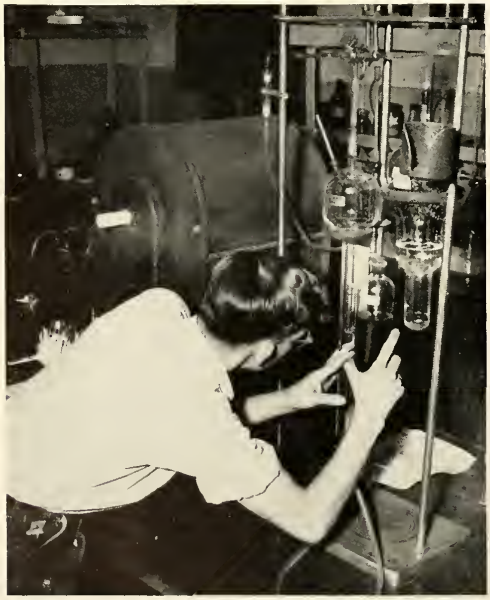
3. A chill test should be made on every ladle poured. In our foundry operations, the chemical composition of the metal, as tapped, is designed for control purposes to take a late inoculation of ferro-silicon, which also has the function of a corrective. Other common alloying elements and inoculants are used as late additions to control metal specifications.

The chill test is conducted by an "alloy man" (our designation) who has been specially trained in the use of inoculants and alloys by teaching him some physical metallurgy and the effect of these late additions on the physical properties of the metal. These alloy men are trained for the job by working with the metallurgical department and the melting foreman. The alloy man is supplied with the tensile strength, Brinell Hardness, transverse strength and deflection, the fractured appearance of the tensile strength specimen, and a chemical analysis of the specimen so that he can compare his chill-test fracture with the tensile strength and the other properties mentioned when they are obtained from the laboratory. This procedure is carried out each time a standard arbitration test bar is poured.

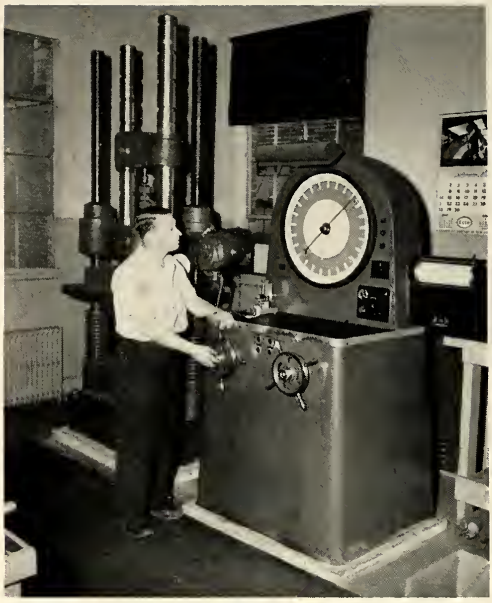
We have numerous castings which are required to be within a certain range of hardness at points agreed upon by the customer and the foundry. It is customary for us to move the Brinell Hardness machine to the work station of the alloy man when these castings are in production. In this manner we have a direct correlation between chill test and hardness in the casting each time a ladle is tapped from the cupola.

CHEMICAL ANALYSIS FOR METAL CONTROL

The analysis of casting defects will indicate the need for metal control and, if a start toward controlling metal chemistry is made, its effect will be far reaching. Normal



Cleaman L. Bain, Laboratory Technician, determining the per cent total carbon by the combustion method.



Lawrence Lang, Laboratory Technician, making a tensile strength determination.

gray iron, containing carbon, silicon, manganese, sulphur and phosphorous, is a complex material, and it is now being further complicated by the presence of residual amounts of the commonly used alloys of nickel, copper, molybdenum, chromium, vanadium, and undesirable elements such as aluminum, tin and lead.

Some of the procedures which we have incorporated with our melting operation for control purposes are as follows:

1. All metallurgical coke is forked from the railroad car to prevent breakage. Clam-shelling coke is not permitted under any circumstances.

2. Silvery pig iron, ferro-manganese and other concentrates are weighed upon small appropriate scales rather than on the regular charging scales.

3. Automotive cylinder blocks, our only source of purchased cast scrap, are stripped of all aluminum, bearing metals, copper gaskets, crankshafts, cast iron high of phosphorous content, and rubber.

4. Foundry return scrap, alloyed and regular melt, is separated at the foundry shake-outs and stored on separate piles in the yard.

5. The cupola blast is weighed by a GE air-weight control on the blower.

6. Carbon electrodes and graphite anodes are used in the coke charge to increase total carbon content in the iron. With these materials, it is possible to compensate for metallurgical coke which may be below standard in strength and carbon-raising ability.

7. Coke, which we receive from three suppliers, has been evaluated metallurgically and from the point of view of economics. Coke from the three sources is interchangeable in our melting operations at Lynchburg.

Hardin B. Gilley, Jr., Laboratary Technician, moking a sulphur determination by the combustion method.

8. Metal tapped from the cupola is desulphurized to a selected range by an addition of fused soda ash. We have recently found that sulphur is one element in cast iron which affects physical properties rather drastically and should be controlled within a suitable band of narrow tolerance.

9. In this discussion only a few of the major procedures for metal analysis control are listed. For more complete information concerning our control of cupola melting and metal chemistry, it is suggested that you review the various papers prepared and published by W. W. Levi. His work is a continuation of a study started by Max Kuniansky about thirty years ago. It should be pointed out that the quality control program for control of cupola melting and chemical composition of gray iron melted in the cupola has been in progress for this period of time at the Lynchburg Foundry Company. Mr. Levi has concentrated his efforts from 1934 until the present time in refining and improving cupola melting. Recent developments in the metallurgy of cast iron have indicated that there is still much to be learned about cupola melting.

SAND CONTROL

There is not much doubt that an active program of sand control is vitally necessary in the modern foundry.

Graphite onedes are carefully sized for use. The one at the left was taken from the cupola drap.

Scrap losses from sand causes, cleaning costs and fast molding equipment require the sand properties to be held within reasonably close tolerances.

Sand control, as such, does not mean simply making sand tests on the equipment now available for such purposes. It must go beyond the record of the laboratory technician to someone who analyzes the tests and takes steps to control all the properties within the necessary tolerance band for each.

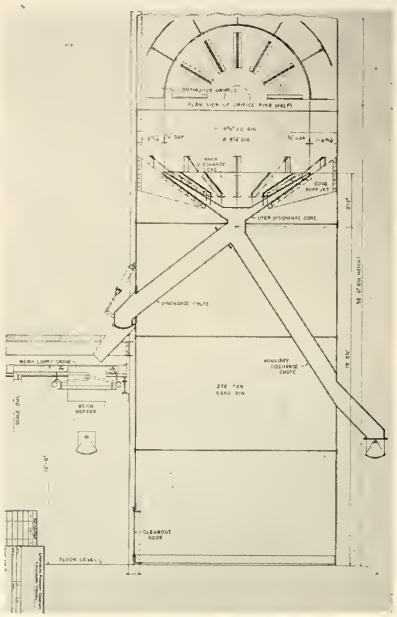
Work in the sand control field involves a very thorough study to establish the character of the basic materials from which the sand mixtures are made. Then, a study must be made of the contemplated blend of these materials in the form of a mixture to go to the molding machines. Each piece of equipment, the muller, the

Herschel Godsey removing test blocks of sond from the experimentol oven in the loboratory.

elevator, the aerator, the molding hoppers, and the shake-out belt, has an effect upon the properties of sand, and it is necessary to have this information before practical sand mixtures can be developed and controlled.

At the Lynchburg plant, we have the main sand laboratory for both company plants. It is equipped with testing devices to study sand at room temperature in the green state, to study sand in the dry state at medium elevated temperatures, and to study sand properties at high temperatures. In our two plants, Lynchburg and Radford, we have three shop laboratories located at the sand mixing stations where we test sand in the green state for moisture, permeability, green compression, and deformation. For best control, it was found necessary to establish these sand testing laboratories at the mixing stations rather than have the main laboratory attempt to do this work.

We have had an interesting experience in selling sand control to the foundry Operating Group which may prove valuable in your work of expanding quality con-



The orifice in the shop silo.

trol. When the laboratories were installed at the mixing stations, we felt that the laboratory technician could ably control the mixtures set forth by instructing the operators of the mullers from the results of his tests, but this was not successful. We tried having the laboratory technician report the results of the sand tests to the muller operators and attempted to control the sand mixtures by having muller operators assume responsibility, and this was also not successful. Our best results have been to establish a group of men who are interchangeable in the sand testing laboratory and in operating the mullers. In this way, all of the group recognizes and appreciates his fellow workers' problems and work very successfully as a team.

It was our practice to have the laboratory technician record his test results on preprinted forms. This form had a separate chart showing the desired range of the properties for which the technician was testing. There has been an appreciable improvement in the control of the sand properties at the muller by having the men plot control curves, each having its own band of control.

Some of the procedures which we have found necessary and which may be incorporated into shop practice without difficulty, are listed as follows:

1. Weigh all dry components of core and molding sand mixtures. Carefully measure with standard liquid measures, not with a bashed-in tomato can, all liquids which are part of molding and core sand mixtures. It is preferable to meter these liquids.

2. Establish fixed mixing cycles for the equipment used to prepare core and molding sand mixtures. It is definitely advantageous to mull or mix the sand at lowest possible moisture content with the dry additives for a specified time before adding liquids such as core oil, synthetic resins, and water. The desired properties in the sand mix should be established by adjusting the bonds and mixing cycle and this can best be done by testing the sand at various intervals during the mixing cycle.

3. Strive for a control of grain segregation in the dry silica sands used in your core mixtures.

4. Determine the proper baking temperature and time for cores by using temperature pellets embedded in the center of the core in the green state.

5. To control ramability of the molding sand, it is strongly recommended that the green compression-deformation or green compression-tensile tests be used rather than a test for green compression or green shear strength individually.

6. Test new sand on arrival at the foundry and work out testing procedure so that you have a representative test. Compare your findings with that of the producer and work this problem of testing out carefully. Representative tests of your own and by your supplier will form the basis for improvement by a more careful selection or preparation of the base sand.

7. Sand tests made at the mixing stations in the shop as rapidly as the technician can perform them will indicate sources of variables in the molding system which can be traced and then eliminated.

It should be pointed out in this discussion of sand control, as we have pointed out in the discussion of cupola melting, that our sand studies have been going on for a period of years. Mr. Kuniansky purchased the first

Weigh lorry and scale for core sand mixture. Warren V. Phillips is the operator.

set of sand testing equipment manufactured by Mr. Harry Dietert in 1924 and we feel we are still far from perfection.

INSPECTION

The work of our inspection department has been outstanding in our quality control program, particularly so in reducing our rejects in the field and actively entering into the effort to eliminate rejects in the foundry with the result that foundry scrap has been reduced.

Inspection personnel work with every department within our company and with the people supplied by the customer in his plant who are best qualified to cope with the particular problem involved. Their work begins with a deviation from expected quality which directs their attention to patterns and core boxes, flask equipment, design of jigs and fixtures for foundry and machine shop operations, dimensions of baked cores, chaplet design, metallurgy (if porosity or machinability is the problem), pattern shrinkage, and to other equipment and production procedures for making the casting.

The success of the work of our inspection lies in the fact that it has not been satisfied to just rule that the product is or is not satisfactory, but studies the problem carefully enough to initiate action to have it corrected. In our foundry, we could well change the name inspector to foundry methods engineer in order to better describe the scope of the work.

The inspection department was created to prevent the shipment of obvious scrap castings which should have been rejected by the ordinary visual inspection. The work in this stage involved only visual inspection on the shipping dock but during the past few years, has expanded to its present place in our foundry organization. Both plants had individual inspection, somewhat isolated from each other, of this nature.

The foreman of the inspection group reported directly to the plant manager, not to the foundry superintendent,

Russell G. Moon meosuring woll thickness on a production costing.

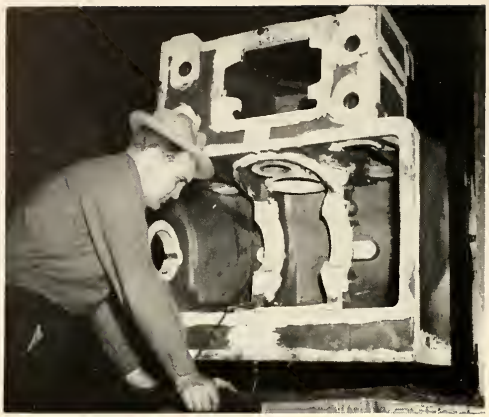
and under his direction developed inspection as we have it today. When the Lynchburg plant inspector was made chief inspector, and responsible for inspection at both plants, his immediate supervisor was changed to the assistant general manager. Recently, the supervision of inspection has been assigned to the director of manufacturing research and methods, indicating that the work of the inspection department is more that of the methods engineer than general inspection.

For the purpose of developing better quality control, however, it is significant that the inspection department has extended its work and expanded its activities under the direction of the plant manager. The latter changes in supervision of inspection have not been in effect sufficient time to judge whether there is a distinct advantage in the most recent change in organization.

Briefly, the duties of the inspection department and the general scope of their work is as follows:

1. A roving inspector, on duty each hour that castings are being made, proceeds from shake-out

General view of layout tables where periodic dimensional checks ore made on production castings. Left to right: Cecil E. Austin, Shop Instructor; Robert E. Trent and Mosil D. Hanks.



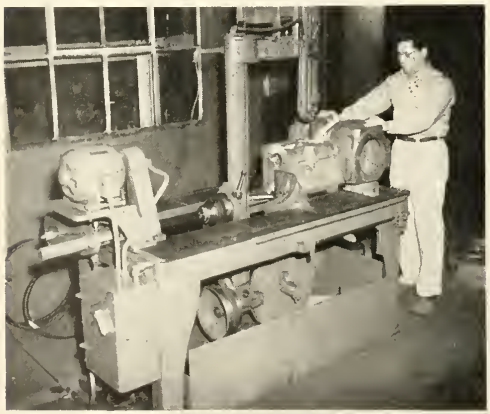
James R. Bobbitt, Chief Inspector, Radford Plant, checking dimensions on a large transmission case.

to shake-out and to the various cleaning stations to check for defective castings. He is specifically interested in the appearance of those defects which, by experience, we know may appear on a certain casting. The defects which he searches for are those for which we have not installed corrective measures or where we have not had the opportunity to correct some discrepancy in the pattern.

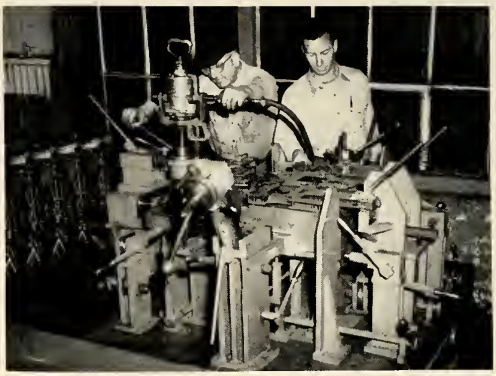
2. The chief inspector has a regularly scheduled visit to all of our customers' plants. A careful study of all rejected castings, which are held from visit to visit for his check, and all other product defects is made.

3. All engineering changes requested by the customer are handled by the inspection department. Pattern changes are made, sample castings are produced, marked and forwarded to the customer. Upon final approval by the customer, inspection releases the change to the production office.

4. Inspection periodically (usually once an hour depending on the size of the casting) selects a casting at the shake-out, expedites it through cleaning and takes it to the lay-out plate for dimensional checks. One of the very important assignments of the inspection department begins at the lay-out plate. Depending upon what is found in the way of defects or dimensional discrepancies, the inspector on the plate proceeds immediately to the foundry foreman responsible for the condition and works with him to eliminate it. This work involves gauges for flasks and close-up pins, core-rubbing fixture adjustment, core-assembly adjustment, and the core-setting operation, particularly if we are using a shim of any nature.



James K. Taylor cutting a casting in order to check for porosity and to measure internal dimensions.



This special jig is for grinding locator pads for the machining operations on this transmission case. Jennings H. Morris is the operator; Waldo C. Watkins, Chief Inspector, Lynchburg Plant, observing.

5. Certain castings from each day's production are specified for destructive testing for internal porosity, physical properties in the casting, and for measurement to check wear on patterns and core box equipment. This work is carried out in conjunction with the metallurgical laboratory.

6. Inspection has taken charge, for good reason, of the metallurgical inspection of certain chilled iron castings and the Brinelling of all production castings where a 100% Brinell check is necessary.

CONCLUSION

When we speak of control in the foundry, we mean elimination of some of the variables which enter into the making of the casting, as well as recognition and development of means of compensating for other variables that cannot be immediately or entirely eliminated. Quality control, therefore, means the continued effort to cope with and compensate for variations in regular foundry production procedure in order to assure a satisfactory casting for our customer each time his casting is reproduced. We must keep in mind that the customer will continue to demand further product improvement, and our efforts must be so directed as to anticipate and be prepared for such demands.

The perfect casting has never been produced. We should shoot at this perfection target with a quality control gun.

PROJECTS UNDER DEVELOPMENT

It should not be forgotten that quality control is equally important in the development of new products and methods as in maintaining quality in existing castings. In turn, these same new developments have also permitted us to better understand and have more accurate control over standard production methods.

Some of the projects which, when completed experimentally, will be very useful in further improvement in our quality control program are as follows:

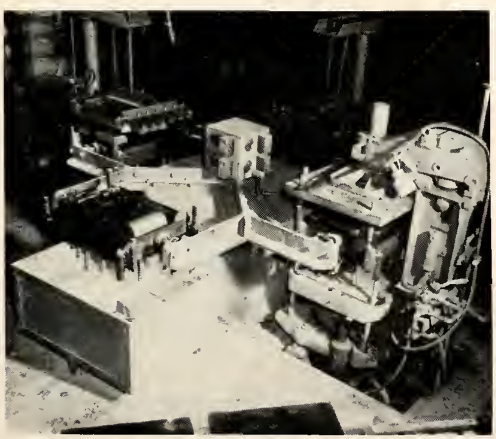
(1) A study of the effect on melting control by adjusting the chemical composition of the slag in an acid cupola. Laboratory equipment for the chemical analysis of these slags has been found necessary to correlate our slag chemistry with the metal chemistry.

(2) Two new compounds, which are to be used in conjunction with the synthetic resin binders in the core mixtures, are now under study. The use of these materials will improve our dimensional control of baked cores.

(3) The work of the Pilot Foundry is being extended into all phases of making and cleaning a casting. New personnel and equipment are being introduced to the Pilot Foundry operations so that we can make more fundamental studies of gating and risering, sand properties, and the mechanical equipment for making molds.

(4) A pilot operation for shell molding has been in operation for almost a year. It is expected that the procedure for handling shell molded castings will improve the handling and cleaning operations of our regular castings.

(5) We have been working for the past two years in the laboratory and on a semi-production basis in one of our melting operations with the use of injected calcium carbide. The results of this work indicate some important developments in the metallurgy of cast iron and will unquestionably have its effect on better control of the melting operations.



The experimental shell molding machine.

Wesley A. Martin and Howard E. Perrow applying sand to the shell pattern plate.

(6) The basic cupola has been a production tool in our shops since February of 1951. Our experience with this melting operation has led to improved efficiency in the use of fluxes and refractories in all of our melting operations.

(7) A concentrated program of the application of industrial engineering and work simplification has been successful in removing some of the variables encountered in the foundry operations.

(8) Our sand reclamation unit has been in operation since July of 1951. This equipment, together with our sand storage silos, has resulted in a better control of grain classification in the core mixtures and, subsequently, better baked core dimensions. We are considering minor changes of both of these units which will further refine our control of the distribution of grain size in our cores.

(9) Automatic timers have recently been introduced in the molding operations for control of shake-out temperature and its effect upon metal structure in the casting. This equipment will give us better control of the baking operation for our large cores.

(10) Use of spectrographic analysis of our metal is being extended to control the subversive elements in cast iron.

(11) We have already completed a laboratory study of the use of a polyelectrolyte (Lustrex X-886) soil conditioner in molding sands and have had a ten-day operating test in full production in the foundry. Results indicate that the use of this material may give us better control of our molding sand mixtures by reducing the number of materials used in the mixture, permitting greater latitude in their amounts, and improving our control of ramability.

(12) New materials and procedures for making ductile iron are under study. The use of ductile iron as a new engineering material will increase, and we are studying the melting controls necessary for its production. Each new development has required improvement in melting control and has invariably permitted some parallel improvement in our regular melting control.

1952 Apprentice Graduates—Seated, left to right: Curtis W. McCarmick, Foundryman; James S. Bumgarner, Machinist; Joseph R. Hurt, Electrician; Marshall M. Thompson, Foundryman; Cecil E. Austin, Foundryman; Waldo C. Watkins, Foundryman; and Kyle D. Tweedy, Patternmaker. Standing: Durward S. Andersan, Electrician; Thomas K. Moore, Machinist; Clyde T. Doss, Machinist; Calvin A. Davidsan, Machinist; John W. Linkous, Patternmaker; Larry W. Hurt, Laboratory Technician; James R. Bobbitt, Faundryman; and Fred W. Childress, Faundryman.

Apprentice Graduation — 1952

ON Friday, November 7, 1952, the Lynchburg Foundry Company had over 180 dinner guests at the Patrick Henry Hotel in Roanoke. The occasion was the graduation exercises for fifteen men who were to receive certificates from LFC's Apprentice Training Program. Among the guests were members of the company organization who had helped in the training of these men, men who had worked with them, former graduates of the program, members of the top management of the company, and many wives, sweethearts, and well-wishers. It was a very happy occasion and a fitting tribute to the newest members of a distinguished LFC family.

In addition to the certificates given by the Lynchburg Foundry Company, the graduating class also received certificates from the Virginia State Apprentice Council and the International Correspondence Schools.

A glance at the past may give us some indication of what will happen to the men of this class. Of the one hundred and nine men who had been previously graduated from the Apprentice School, eighty-one are still a part of the LFC team. All eighty-one were present in that room on Friday evening. Forty-eight of this group are skilled journeymen: sixteen are top-rated machinists and maintenance workers, fifteen are patternmakers, nine are molders and coremakers, seven are electricians, and one is laboratory technician.

There are thirty-three more to be counted. Ten of them are supervisors in the Machine Shop and Maintenance Departments. Fourteen more are supervisors in the Foundry, and one each in the Pattern Shop and the Electrical Maintenance Department.

There are still seven left. An Assistant Works Manager, a Foundry Engineer, a Time Study Engineer, a Superintendent of Foundries, a Sales Engineer, and Chief Estimator will fill out the list.

Perhaps the class of 1952 will not follow this pattern.

John J. DeHart, Jr., Training Directar; Dr. J. O. Christianson, after dinner speaker for the occasion; C. W. McLennan, Personnel Directar; and Max Kuniansky, Executive Vice-President and General Manager.

It is much more likely that it will, and in so doing will once more reaffirm the confidence and trust that all members of the company organization place upon the graduates of the Apprentice Training Program.

What of the future? A glance at the enrollment of the program as of the seventh of November shows that there are forty-nine men in various stages of their training in the Lynchburg and Radford plants. Clearly, the program has a great deal more in store for both the employees and the company alike.

At the ceremony, Max Kuniansky, Vice-President and General Manager, presided in the absence of Henry E.

Dr. Christianson delivering his excellent speech. Max Kuniansky and Emmett C. Wood at the speaker's table.

McWane, President, whose recent operation prevented him from attending the program. Rev. Emmett C. Wood, Pastor of the Sandy Bottom Christian Church and Assistant Superintendent of the Lynchburg Special Foundry gave the benediction, and Dr. J. O. Christianson, Superintendent of the School of Agriculture, St. Paul, Minnesota, delivered the principal address of the evening.

The title of Dr. Christianson's speech was "Our Part in These Times." The theme of the speech was the need for a return to the basic tenets of our civilization. He stressed the roots of our civilization; the home, school, church, community, and private property. But, the return is not enough, by itself. He scored the danger of a philosophy of "helplessness," and reminded us of the duty of the individual to participate in his government, regardless of party affiliations.

Essentially optimistic, Dr. Christianson pointed out that throughout the centuries of recorded time, the things that "make us more than beasts" have survived in spite of "black periods of history." He emphasized that those things are part of a standard of life, not a

John J. DeHart, Jr., awarding the certificate to James R. Babbitt.

standard of living; that they are concerned with the things that the individual belongs to, not what belongs to the individual. The place of the standard determines to a large extent the relative "happiness" of the individual, according to Dr. Christianson. He stated that "Happiness is a journey, not a destination."

In conclusion, Dr. Christianson divided up the youth of the world by population in order to underline the fact that though our country produces nearly half of the worlds goods and services, only five persons out of every one hundred persons in their teens come from the United States. He made it clear that the responsibility of the country was to these five individuals, and that the material wealth that we might bestow upon them was as nothing unless they were trained to use their opportunities intelligently. Such training, as was being rewarded that evening, was what he had in mind.

After John J. DeHart, Jr., Training Director, had awarded the certificates, Mr. Kuniansky adjourned the meeting, and we left with the feeling that we had seen and heard something very worthwhile. Congratulations to the new journeymen.

Fred W. Childress receives his certificate from John J. DeHart, Jr.

The attractive display booth of the Lynchburg Foundry Company shown in Philadelphia's Convention Hall.

Lynchburg Foundry Company — — National Metal Exposition

Again, in 1952, the Lynchburg Foundry Company participated in the National Metal Exposition. The 1952 show, largest in the 34 year history of the event, was held in Philadelphia's vast Convention Hall during the week of October 20-24. There were five huge show rooms devoted entirely to exhibits, and these rooms were filled with aisle after aisle of colorful, well-appointed, and interesting display booths. Over 3700 badges were issued to exhibitors staffing 384 booths, and 78,863 people came to see the show. When the aisles were full of visitors and the show was in full swing, the panorama of the National Metal Exposition was brilliant and vivid in its immensity.

The interest in the company booth was most gratifying.

T. M. Bost, Jr., Sales Engineer, headed the staff of the Lynchburg Foundry Company's booth. Several members of the Sales and Metallurgical Departments gave much needed assistance during the week long show, for at times, there were as many as thirty visitors in the booth. The accompanying picture shows a scene that was the rule rather than the exception. Truly, the response to the display was wonderful.

The booth, pictured above, contained numerous photographs showing many phases of the plant operations both at Lynchburg and at Radford. In addition, a representative cross-section of the smaller green sand castings was displayed. It was gratifying to hear the many favorable comments on both the quality and intricacy of the LFC work.

The display of shells and shell-molded castings was especially interesting to many of the visiting engineers. Everyone in the booth was kept busy trying to answer the barrage of questions, both technical and general, which concerned the new process.

The 1952 show, like its predecessors, offered the company an opportunity to renew old acquaintances and to make new friends in an atmosphere where helpful information was freely exchanged. It is hoped that the National Metal Exposition will continue to be the pleasure and privilege in the future that it has been in the past.

NATIONAL SAFETY COUNCIL

A·W·A·R·D

TO

LYNCHBURG FOUNDRY COMPANY
LYNCHBURG, VIRGINIA

IN RECOGNITION OF ITS OUTSTANDING ACHIEVEMENT
IN REDUCING THE FREQUENCY OF DISABLING INJURIES

GROUP B, FOUNDRIES DIVISION

METALS SECTION SAFETY CONTEST

JULY 1, 1951—JUNE 30, 1952

Ned H Dearborn
PRESIDENT

Lynchburg Plant Receives National Safety Award

IN November, 1952, the Lynchburg Plant of the Lynchburg Foundry Company received recognition by a national award for the improvement in its safety record. This award, reproduced above, is given by the National Safety Council, a "non-profit organization devoted to the prevention of accidents of all kinds." The Council "carries on a continuous national program of accident prevention and stimulates interest in safety in all fields through cooperation with other organizations."

The Council divided up the participating foundries into three groups according to the number of man hours worked in the twelve months between July 1, 1951, and June 30, 1952. The Lynchburg Plant was classified in the "B" group along with twenty-nine other foundries.

Awards were presented to those plants having the lowest frequency rates. The frequency rate is the function of lost time accidents per million man hours worked. Our frequency rate was 8.69 which means that the Lynchburg Plant had between 8 and 9 lost time accidents for every million man hours worked. Extending our figures further, we find that approximately every six months, one million man hours are turned in at Lynchburg. Therefore, lost time accidents occurred slightly more often than once a month.

In this contest, the Lynchburg Plant placed fourth out of the twenty-nine competing foundries. The winners were:

1. International Harvester Waukesha Works..... .00
2. Ford Motor Co., Cleveland, Ohio..... 2.22
3. U. S. Pipe and Foundry, Birmingham, Ala... 7.81
4. Lynchburg Foundry Co., Lynchburg, Va..... 8.69

The average frequency rate of all foundries entered in the contest was 17.82.

It is very clear where the credit is due. Every employee working at the Lynchburg Plant deserves heartiest congratulations. It is also very clear where our target for the next contest is. It is at the top. We offer congratulations to the employees at the International Harvester Plant at Waukesha. We hope that their frequency rate stays just exactly where it is and we hope to join them in that category next year.

Theadore G. Offterdinger, Safety Director, presents the award to Hampton W. Campbell, Works Manager at Lynchburg.

The iron-master's house at Hammersmith.

Hammersmith, U.S.A. — The Nation's First Iron Works

By George E. Sullivan

FOR almost three centuries the very beginnings of the steel industry in the United States have been buried beneath the grass and greenery of a small town in the State of Massachusetts named Hammersmith. It was here that upwards of one hundred men once toiled to make pots and pans, nails, bolts, chisels, mattocks and other implements so necessary in the daily life of the colonists. It was here, in the seventeenth century, that the first combined production of cast and wrought iron in the New World was achieved.

Our nation's first iron works had a productive life of almost thirty years, dating from its construction in 1646. For a variety of reasons, by 1678 Hammersmith was completely abandoned and its most astute workers were seeking to ply their respective trades in other colonial villages. By the twentieth century the iron-master's house and a non-descript pile of slag were the only recognizable features of an enterprise that at one time had supplied colonial America with a ton of iron a day.

As time went on the iron-master's house came to serve as a museum for colonial handicrafts and in 1942 it was purchased with the thought of moving it to Michigan as a gift for Henry Ford to add to his collection of early houses at Dearborn Village. This proposal aroused the ire of the "proper Bostonians" near Hammersmith. With the ultimate intervention and cooperation of Governor Saltonstall of Massachusetts and Mr. Henry Ford himself, the structure was saved for New England. Soon after, the work of restoration was begun.

Preliminary explorations and excavations of the land in the vicinity of the iron-master's house revealed actual furnace foundations and bellows base timber evidence. With this revelation, some of the country's better known archeologists, architects and historical researchers were

An archeological crew removing the 505 pound hammer-head at Hammersmith.

Bog iran ore dug from low-lying marshes and old stream beds fed the Hammersmith furnace. A rock ore fram nearby Nahant was alsa used.

called upon to assist in the restoration. Their searchings brought to light the names of those responsible for the enterprise. It was learned that John Winthrop, Jr., son of the first governor of Massachusetts provided the original impetus for the works. Already familiar with the principles of iron-making, Winthrop was given the financial backing of a group of English industrialists and formed the "Company of Undertakers for the Iron Works in New England."

This organization combined men with technical and marketing experience in the field and also Puritans favorable to the ecouomic aspirations of their brethren in the colonies. Winthrop's capital raising effort came at a fortunate time for England's iron manufacture was an expanding industry, struggling to keep up with the needs of a growing population.

After surveys from Maine to Plymouth, the embryonic industrialist first selected Braintree, Massachusetts, as the site for his furnace. There, in 1644, Winthrop began work. However, shortages of ore and water developed that brought on early failure and though Winthrop went on to become a key figure in the development of New England, the "Company of Undertakers" assigned Richard Leader to take over the property. It was Leader who selected the Hammersmith site for it offered a combination of bog ore, extensive woodlands, a natural elevation to serve as a base for the furnace-charging bridge, and a navigable stream which could be dammed above the works to provide their water power.

Today Hammersmith stands out as an impressive technological achievement; it had the misfortune of being well-advanced of its time. Quite logically, the essentials employed in its manufacture of iron were in many ways similar to the productive processes used to-

An enormous quantity of wood was cut by neighboring farmers working in off seasons. Later, indentured Scats did this job.

The wood was converted into charcoal by slow burning in sod-covered kilns. This work was done by skilled and highly paid colliers.

day in the country's gigantic steel plants. Needless to say, they were not nearly as grandiose.

Hammersmith "miners" dug both a bog iron ore and a rock ore with pick and shovel from low lying marshes and old stream beds and then transported it by ox-cart to the furnace. Coal, today the second most important raw material in the production of iron, was not used to smelt down the ore. Instead, enormous quantities of wood were cut by neighborhood farmers or indentured Scots. Skilled and highly paid colliers converted the wood into charcoal by slow burning in sod-covered kilns.

The charge of ore, charcoal and fluxing materials, and small amounts of coral, were then dumped into the furnace top by men who made use of a wooden bridge that stretched from a nearby embankment to the mouth of the furnace. The molten iron was drawn off near the base of the furnace and run into molds in a bed of sand. A trench was cut in the sand for the iron to flow through where it eventually cooled. Through the years the main trench came to be known as the "sow" and chunks of metal which cooled in smaller trenches were called "pigs." Nowadays, of course, machines are used to cast the metal though the chunks still bear the name pigs.

Workers at Hammersmith melted the iron from the pigs in their forge and worked it up in a series of hammering and reheating operations into wrought iron. Finished products were sold at the site of the works and then were hauled by boat or by cart to meet the needs of smiths and merchants in nearby towns, or were shipped to a central warehouse in Boston for local sales or shipment overseas.

Despite so many of nature's gifts, production was not immediately profitable at Hammersmith. Burdened by

The charge, consisting of bog ore, Nahant ore, charcoal, limestone, and coral, was dumped into the top of the furnace.

The water wheel supplied the power to operate the huge bellows for the early blast furnace.

increasing financial obligations and a steady decline in its local credit position, the Massachusetts courts decided the Company's property should be delivered into the hands of its creditors.

After a few years of fitful production, a colonial merchant named William Paine acquired enough of the stock to gain control of the works. Under Paine's control production hit an all time high. Between 1658 and 1663 the works averaged 300 tons of bar iron per year in addition to the manufacture of smaller quantities of cast ware and tools. Paine died in 1660 and under his son who replaced him, work slowed down considerably. It had drawn to a stop in 1675. Three years later Hammersmith was comparable to a gold rush ghost town.

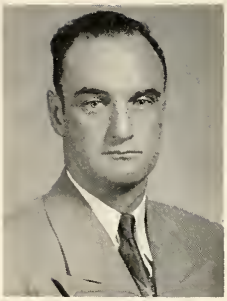
Back of the continuous line of failures lay many factors: mismanagement, shortages of raw materials, inability to meet competition of imported iron, conflicts with local authorities, and difficulty in obtaining and keeping workers in a locale where land was cheap and labor dear. There was, in addition, a great deal of public opinion opposing the method of manufacture of iron by simple, direct process forges (though this was the system to be employed in later colonial iron works).

For all of its shortcomings, Hammersmith was the equal of the best contemporary plants in England and the wonder of the time in the colonies. All other early iron making attempts in New England had ended in failure.

It was from this industrial root by the Saugus River that the steel industry has grown, until today it is capable of producing over a hundred million tons of steel a year. Thus, Hammersmith is at once a shrine to pioneer capitalists, managers and workers of colonial days, and a monument to the men of industry who in later generations helped to develop the American economy in a climate of freedom.

Iron was melted from the pigs in the forge hearths and was worked up into wrought iron by a series of hammering and reheating operations.

Jesse L. Baker



John C. Baker

Dennis B. Matney

Recent Promotions at Radford

JESSE L. BAKER started with the company in October, 1928. He held a number of different jobs in various departments until November, 1930, when he became an apprentice electrician. He worked as an electrician from the time he completed his apprenticeship in 1936 until he became Assistant Chief Electrician in November, 1948. He held this assignment until November, 1952 when he was promoted to Maintenance Foreman.

Jesse has filled a number of important posts both for the company and the community. He has been President of the Radford Credit Union, and Chairman of the Plant Safety Committee for several years. He is at present a member of the Radford City School Board, a member of the local Selective Service Board, and is on the Governing Board of the Regional Negro High School at Christiansburg.

JOHN C. BAKER was employed as an apprentice machinist in August, 1941. His training was interrupted from November, 1941 until October, 1945, while he served with the Armed Forces. He was an Operations Sergeant during the Italian and German campaigns and was awarded the Bronze Star. Upon his discharge, he resumed his training and completed his apprenticeship in November, 1948.

He became a lead man in the Maintenance Department after his graduation from the Apprentice School and was promoted to Maintenance Foreman in November, 1952.

DENNIS B. MATNEY was employed in the Radford Maintenance Department in March, 1941. In August of that year he enrolled in the Apprentice School as an apprentice machinist. From November, 1942 until November, 1945 he served as an Aviation Metalsmith in the Navy. He resumed his apprenticeship immediately upon returning to work, and completed his training in July, 1948.

He was a lead man in the Maintenance Department from February, 1951, until November, 1952, when he was promoted to Maintenance Foreman.

Report on the Proposal for Improvement Plan

ACCEPTED DURING THE PERIOD SEPTEMBER-NOVEMBER, 1952

By WILLIAM S. WILLIAMS, *Work Simplification Director*

Milton B. Young

MILTON B. YOUNG, Radford Special Foundry, submitted the following proposals:

1. A new method of ramming up a small core box on a production casting made possible the elimination of some of the loose pieces in the box and thus reduced the labor time. Award $5.00.

2. Delivering and storing coke at the Special Foundry in rail car loads has reduced the overall handling costs considerably. Award, $5.00.

JOSEPH J. DUNCAN, Radford Special Foundry, suggested that extra sizes of flask wedges be made to save that time formerly spent in looking for insert blocks and makeshift wedges. Award paid, $9.50.

Joseph J. Duncan

Mrs. Arlene Gilbert

MRS. ARLENE GILBERT, Order Department, worked out a new method of writing up mechanical joint fitting orders that completely eliminated any duplication in describing the accessories. This idea saved time for everyone who copied, read, or used these orders. Award paid, $26.50.

William E. Weeks

WILLIAM E. WEEKS, Radford Standards, was responsible for eliminating the job of filing nail grooves in plug cores. Now the grooves are cored in, greatly reducing the total labor cost. Weeks is not eligible for a cash award.

Claude S. Fletcher

CLARENCE A. TAYLOR, Lynchburg Inspection, developed an ingenious method of spreading oil on the interior of certain castings in checking for leaks. This method saves oiling time and also makes possible a much more thorough inspection. Award paid, $5.21.

Clarence A. Taylor

CLAUDE S. FLETCHER, Lynchburg Inspection, proposed that a flow-over strip, cored into the chaplet core, be used on certain castings to reduce leaks around the chaplets. The success of this idea was reflected by a considerable reduction in the number of chaplet leakers. Award paid, $18.38.

C. E. Goodman

CLARENCE E. GOODMAN and MALCOLM THURSTON, Lynchburg Maintenance, worked out a better method of repairing and building up sand mill plows. This idea has resulted in much longer plow life and a lower maintenance cost. Award, $79.60 each.

Malcolm Thurston

ALBERT W. STEVENS, Lynchburg Machine Shop, designed a simple device for clamping a production casting on a milling machine, making the job much faster and easier. Initial award, $10.00. Estimated additional award, $15.00.

ROBERT S. STANLEY (not pictured), Lynchburg Special Foundry, proposed that a rod be bolted between the ends of flask bars on certain deep draw molds to give more rigidity to the flask. This idea has greatly reduced scrapped molds on this type of job. Award, $10.50.

Hubert J. Moorefield

WILLIAM H. MARTIN (Not pictured), Radford Maintenance, found a better way to make up steel rubbing bars for the core floor. His new method not only saved considerable material, but also made the job quicker and easier. Initial award, $10.00.

Albert W. Stevens

HUBERT J. MOOREFIELD, Lynchburg Cleaning Shed Foreman, proposed a new method of handling dry sand in the foundry that resulted in the present indoor chutes in the sand silos. These chutes allow ready access to dry sand whenever it is needed. Moorefield, a Yard foreman when this idea was submitted, is not eligible for a cash award.

Mrs. Juanita Hicks

MRS. JUANITA HICKS, Lynchburg Production, suggested that customers' names be printed on packing list forms with our multilith printing machine when the forms are originally made. This eliminates having to send these forms to the Order Department for a second printing operation. Award paid, $9.50.

Waldo C. Watkins

WALDO C. WATKINS, Lynchburg Chief Inspector, proposed that identifying marks be put on castings as they go through the cleaning process to help in controlling work loads and output. Since this idea was submitted before Watkins was promoted to his present position, he is eligible for an award of $6.75.

European Diary

By Hugh K. McGavock, *Chief Development and Design Engineer*

A day by day account of the European trip taken by Max Kuniansky, Executive Vice-President and General Manager, T. W. Curry, Director of Manufacturing Research and Methods, and Hugh K. McGavock.

November 15—Leave Lynchburg for New York City.

November 16—Leave Idlewild Airport 4:45 P. M. on Pan American Strato-Clipper, "The Mayflower." Arrive Gander, Newfoundland, 10:00 P. M. Refuel. Snow 4 to 6 feet high around Airport. Leave Gander 11:00 P. M. for Shannon, Ireland.

November 17—Shannon fog-bound. Landed at London Airport 11:05 A. M. Through customs and off to Savoy Hotel, headquarters for stay in England. Lunch and rest. Went to see Mr. Kenneth Marshall, Director of the Joint Iron Council. Discussed objectives of trip. Made arrangements to visit Stanton Ironworks Co., Ltd., near Nottingham, next day.

LONDON

November 18—Hired car and drove to Stanton. Very enjoyable visit with Mr. Wilson, Deputy Managing Director, Mr. Morgan, Metallurgist, and other members of staff. Toured deLavaud shop, fittings foundry, and mechanized foundry which is being refitted for commercial castings. Foundry made large calibre shells in last war. Had tea. Received souvenir diaries. Left Stanton 5:30 P. M. Arrived Hotel 9:30 P. M. Very tired. All agree Stanton's deLavaud operation excellent.

November 19—Spent morning in London. After lunch to Dagenham to see Ford Motor Co., Ltd., plant. Mr. Renshaw, Metallurgist in Detroit, U. S. A., Mr. Sargood, his assistant, and other members of the staff showed us melting and molding operations. Interesting discussion of gating problems and operation of hot-blast, water-cooled cupolas. Some interesting work on shell-molding being done. Hot press formed shells for stack molds. All small work, piston rings and rocker arms. Back at Hotel about 6:00 P. M. Mr. Handley, Manager of Foundry Department of Ferranti, Ltd., Hollinwood, took us out to dinner. Most enjoyable evening.

November 20—Early train to Birmingham. Arrive 11:30 A. M. Met by Mr. Morrogh, Research Manager for British Cast Iron Research Association. Drove out to Laboratories in Alvechurch. Fine visit with Dr. Pearce, Director and Secretary of B. C. I. R. A., Dr. Angus, Mr. Morrogh, Mr. Parks, and other members of the staff. Many interesting research programs under way, especially quantitative spectrographic analysis of metals and slag. Building a complete model foundry. Lunch in Alvechurch. Toured labs in afternoon. Mr. Morrogh drove us to Stratford-on-Avon and Welcombe Hotel. Rain and fog prevented our seeing the formal gardens of the beautiful hotel. Dinner with Dr. and Mrs. Pearce, Dr. and Mrs. Angus, and Mr. and Mrs. Morrogh.

November 21—Mr. Morrogh drove us to Birmingham to visit Austin Motor Car Co.'s Foundry. Mr. Bamford and Mr. Phillips showed us their cupola, core room, and molding operations. Lunch in company dining room. Mr. Morrogh put us on train for London. Arrived 5:30 P. M.

November 22—Left London Airport 8:00 A. M. Landed Paris 10:45 A. M. Through customs and off to Hotel Royal Monceau before noon. Rest and shopping in afternoon. Folies Bergère in evening.

November 23—Relaxed Sunday morning. Lunch and sightseeing with Lt. Col. Frank H. Holmes as guide. Very pleasant day.

November 24—Down to Col. Holmes' office. Entire morning spent making arrangements for trip to Germany. Col. Holmes very helpful. Leave Paris 2:05 P. M. Big surprise. Couldn't even see wingtips of plane

ZÜRICH

from cabin. Visibility really zero. Cleared up towards Switzerland. Mountains looked like Appalachians from air. Arrive Zürich 4:00 P. M. Through customs. Hired car to Schaffhausen for night.

November 25—To Georg Fischer (Aktiengesellschaft). Wonderful reception from everyone there. Mr. Bürher, Chief Engineer of Industrial Planning, Mr. Götz, Foundry Engineer, Dr. Gut, Metallurgist, Mr. Vogt, Gray Iron Foundry Manager, Mr. Nacgeli, Steel Foundry Manager, Mr. Burgherr, Superintendent of the Steel Foundry, Mr. Beerli, Malleable Foundry Manager, and Mr. Charl Zhender, Manager of Foreign Interests, plus many others. Saw gray iron foundry, core room, and hot-blast cupola operation. Lunch at the Rheinfall, very beautiful. Through steel foundry in afternoon. Wide range of very difficult castings being made. All very impressed with the operations at Georg Fischer. The

RHEINFALL

group took us to dinner in an ancient convent which the company has made over into a club-house, guest house and conference pavillion. Marvellous library on metal-craft from ancient to modern times. Exhibits too. Back to Zürich after dinner.

November 26—To Sulzer Brothers Ltd., in Winterthur. Received by Mr. Stüchel, Director of Foundries, Dr. Zingg, Director of Research, and Mr. Meier, Metallurgist. Through gray iron and steel foundries in morning. Lunch. Through extensive research and control laboratories with Dr. Zingg. To other plant at Bülach with Mr. Meier where Mr. Honegger, Superintendent of the Plant, Mr. Sulzer, Manager, and Dr. Tütsch, Metallurgist showed us around. Small gray iron and Ductile Iron castings. Very interesting. Mechanization in progress. Dinner in Bülach before returning to Zürich.

November 27—Thanksgiving Day in Zürich. Sightseeing around the beautiful old town. Dinner and discussion with Dr. Marincek of Gesellschaft der Ludow. Interesting comparison of pipe-making techniques and talk of Ductile Iron.

November 28—Relaxed morning. Planed for Hamburg in afternoon. Stopped at Stuttgart for customs. In Atlantic Hotel around 10:00 P. M.

November 29—Drove around Hamburg. Much rebuilding done. Docks still show evidence of tremendous Allied Bombing.

November 30—Hired car. Drove from Hamburg to Braunschweig. Four hour trip. Snow and Ice. Very pretty, but very uncomfortable. Checked into Hotel Haus Bethman. Bomb damage terrific in city. Later, Mr. Götz and Mr. Keller, of Georg Fischer arrived. They and Mr. Beerli had arranged trip for us in the morning.

December 1—We all drove to Wolfsburg to visit the Volkswagenwerke. Entire operation except foundry in one building. Unbelievable. Offices, cafeterias, etc., all in same structure. Agreed that it is finest manufacturing building we have ever seen. Main plant in morning. Lunch. Foundry in afternoon. Metal mold, die casting, and shell molding. Air-cooled, intricately finned cylinders made in shells. Barrel cores and cylinder head cores are shell, too. Very interesting. Saw new housing for employees. Boarded train for Hanover with Mr. Götz and Mr. Keller. Dined together there and they continued to Switzerland.

FRANKFURT

December 2—To Duisburg by train arriving late afternoon. Contacted Mr. Grassier of Duisburger Kupferhütte Works. Came to hotel and arranged for trip following day.

December 3—Mr. Grassier forced to be out of town. Mr. Kaiser, Chief Metallurgist, was our host. Hot blast cupola not operating. Told us of new, high-temperature, hot-blast, cupola installation at Eisenwerke Mülheim Meiderich. To Mülheim in afternoon. Mr. Springhoff and Dr. Lauer took us through foundry. Mr. von Gienanth and others showed us new cupola. Fine installation, and though quite new, performing exceptionally well.

December 4—To Eisenwerke Gelsenkirchen AG. Mr. Boos, Dr. Holbe, and others. Talked of deLavaud pipe. Received souvenir clocks. Visited their shop. Fourteen

LONDON

machines! Casting procedures and pipe handling methods novel. Very good for multiple machine operation. Good machine and mold production, good maintenance, and excellent pipe-coating facilities. Lunch. Joined by Dr. Wittmoser. To control and research labs. Then to gray iron foundry. Wide variety of castings.

December 5—Drove to Düsseldorf Airport and planed for London at 11:50 A. M. Fog. Landed at Bovington Airport 30 miles north. Through customs, into car, and off to London. Fog, fog, fog. Couldn't see across street at times. Finally arrived at Savoy.

December 6—Fog even worse. Breakfast scheduled with Mr. Braidwood of Mond Nickel Co. He was unable to arrive before mid-morning. Plane scheduled for New York at 7:00 P. M. London fog-bound. Out of Savoy at 4:00 P. M. Cab to Victoria Station. Normal short drive took 30 minutes. Airline bus to Waterloo Station. Train to Bournemouth, 90 miles S. W. Airline bus to Hurn Airfield. Pan-American Strato-Clipper, "Constitution." Airborne 1:15 A. M. Shannon 3:00 A. M. Up again 4:00 A. M. By-passing Gander. Clear day. Saw coastline all the way down. Idlewild 12:15 P. M. Elapsed time 13 hours Shannon to New York. Few hours for U. S. customs. Missed plane connection. Aboard "Southerner" 4:45 P. M. Lynchburg at Midnight.

Photo. Courtesy Norfolk and Western Railway

The Refectory, Sweet Brior College, Sweet Briar, Virginio